

Re 3/8/2005

SPECIFICATION

Electronic Version 1.2.8

Stylesheet Version 1.0

[*Diagnostic Method for an Electric Drive Assembly*]

Background of Invention

[0001] *Field of the Invention*

[0002] The present invention generally relates to a diagnostic method for determining whether an electric drive assembly is producing a desired amount of torque and to an electric drive assembly which incorporates the method and more particularly, to an electric drive assembly which compares a pair of signals or values in order to determine whether the assembly is producing a desired amount of torque.

[0003] *Background of the Invention*

[0004] Electric drive assemblies are utilized in a wide variety of applications requiring the selective production of torque. Examples of such applications include, but are not limited to, manufacturing or producing an item or causing selective propulsion. It is desirable to ensure or ascertain whether these electric drive assemblies are desirably providing a required amount of torque.

[0005] One strategy to increase the likelihood that a desired amount of torque will be produced by an electric drive assembly includes the use of an electrical current regulator which receives a measured signal which was previously communicated to the electric machine or torque producer and which represents the torque requested of the electric machine. Particularly, the current regulator subtracts this received signal from a second signal which represents the currently desired or commanded torque. The regulator uses this difference or modifier to produce a voltage signal which is used to create a torque control signal which is communicated to the electric machine, effective to cause the electric machine to produce the certain amount of desired torque. The

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Pages 1-8.

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Thanks. R. 3/8/2005.

Appl. No. 10/063,868

Amendments to the Specification:

Please replace the original paragraph with the following replacement paragraph:

Replace paragraph [0023]
~~Paragraph beginning on page 11, line 4, and ending on page 12, line 22 with the following replacement paragraph:~~

[0023] The inverter 24 then applies the received voltage signal to the electrical machine 28, by the use of bus 27, thereby producing an electrical current signal, effective to cause the electrical machine 28 to produce a desired amount of torque. The electrical current signal, which is output from the inverter 24, is also communicated to the current regulator 20, by the bus 27, thereby allowing the current regulator 20 to ensure that the next received electrical current signal is modified by this signal, thereby efficiently correcting for any undesired torque production from the electric machine 28. Additionally, the voltage signal which is produced by the current regulator 20 is communicated to the diagnostic portion 18, by the use of bus 52, where its value is compared with the voltage value which was identified/produced from the model portion 16. Should these compared voltage values differ by at least a certain amount, a diagnostic signal 30 is generated by the controller 12 to a selectively energizable or activatable positive feed back assembly 32, effective to activate the positive feedback assembly and to notify an operator or use of the assembly 10 that a certain operational state (e.g., a state in which an undesired amount of torque is being produced) is occurring within the assembly 10. Examples of such a positive feed back assembly 32 may include, by way of example and without limitation, a selectively energizable light assembly 34 and/or a selectively energizable audio assembly 36. Additionally or alternatively, controller 12 may also automatically (i.e., without use intervention) deactivate

Appl. No. 10/063,868

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the electric machine 28 when the assembly 10 resides in such an operational state. In one non-limiting embodiment, this certain amount exists where the difference between the voltage value identified from the model portion 16 and the voltage value of the signal produced by the current regulator 20 is equal to about 10% of the value identified or selected by the model portion 16. Other threshold values may be alternatively used. In this manner, the user is given a positive indication of the production of an undesirable amount of torque from the machine 28 and the electric machine 28 may be automatically (e.g., without user intervention) deactivated. One non-limiting method which may be used to automatically deactivate the electric machine 28 is to cause the controller 22 to prevent electrical energy from being delivered to the electric machine 28 by the use of bus 50.

nearest higher and lower actually stored torque values are used to interpolatively select a voltage value for the received signal 33. Alternatively, the stored torque value which is "nearest" to the value of the input torque signal 33 is selected in the model portion 16 and the associated voltage of the selected and stored torque value is used in the methodology which is delineated below.

[0021] In operation, the signal 33 which specifies a certain amount of desired torque is input and communicated to the controller 12 by a user or operator of the electric drive assembly 10. The input signal 33 is then used by the controller 12 to access the torque map portion 14, thereby selecting a certain amount or value of electrical current which is necessary to be communicated to the electrical machine 28, by the use of bus 27, to cause the electrical machine 28 to produce the desired amount of torque. The torque request signal is also input into the model portion 16 and the model portion 16 uses the received torque request signal 33 to select a voltage value and/or generate a voltage signal having this value which is required to be output from the current regulator 20, necessary to cause the desired amount of torque to be produced.

[0022] A current signal having a value which is equal to the current value selected from the torque map portion 14 is then provided from the energy source (not shown) and may be communicated to the current regulator 20, by use of bus 50. The current regulator 20 then uses the received electrical current signal to produce a voltage signal and communicates the voltage signal to the pulse width modulator 22 by the use of bus 52. The pulse width modulator 22 then modulates the received voltage signal and communicates the modulated voltage signal to the inverter 24, by the use of bus 25.

[0023] The inverter 24 then applies the received voltage signal to the electrical machine 28, by the use of bus 27, thereby producing an electrical current signal, effective to cause the electrical machine 28 to produce a desired amount of torque. The electrical current signal, which is output from the inverter 24, is also communicated to the current regulator 20, by the bus 27, thereby allowing the current regulator 20 to ensure that the next received electrical current signal is modified by this signal, thereby efficiently correcting for any undesired torque production from the electric

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machine 28. Additionally, the voltage signal which is produced by the current regulator 20 is communicated to the diagnostic portion 18, by the use of bus 52, where its value is compared with the voltage value which was identified/produced from the model portion 16. Should these compared voltage values differ by at least a certain amount, a diagnostic signal is generated by the controller 12 to a selectively energizable or activatable positive feed back assembly, effective to activate the positive feed back assembly and to notify an operator or user of the assembly 10 that a certain operational state (e.g., a state in which an undesired amount of torque is being produced) is occurring within the assembly 10. Examples of such a positive feed back assembly may include, by way of example and without limitation, a selectively energizable light assembly and/or a selectively energizable audio assembly. Additionally or alternatively, controller 12 may also automatically (i.e., without user intervention) deactivate the electric machine 28 when the assembly 10 resides in such an operational state. In one non-limiting embodiment, this certain amount exists where the difference between the voltage value identified from the model portion 16 and the voltage value of the signal produced by the current regulator 20 is equal to about 10% of the value identified or selected by the model portion 16. Other threshold values may be alternatively used. In this manner, the user is given a positive indication of the production of an undesirable amount of torque from the machine 28 and the electric machine 28 may be automatically (e.g., without user intervention) deactivated. One non-limiting method which may be used to automatically deactivate the electric machine 28 is to cause the controller 22 to prevent electrical energy from being delivered to the electric machine 28 by the use of bus 50.

[0024]

It is to be understood that the present invention is not limited to the exact construction or method which has been delineated above, but that various changes and modifications may be made without departing from the spirit and the scope of the inventions as are further delineated within the following claims. Further, in other non-limiting embodiments, the data which is resident within the model portion 16 may alternatively comprises voltage phase angle type data and the data which is obtained from the current regulator 20 and communicated to the model portion 16 may also alternatively comprise voltage angle data. Further, in yet another non-limiting embodiment, the controller 12 may ascertain the production of an undesired amount

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